NMR and Topological Constraints in Borophosphate and Borosilicate Glasses

Invited Talk

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Recent progress in temperature-dependent constraint theory paves the way for design of new multicomponent glasses with tailored properties. Atoms in network glasses are constrained by their chemical bonds and bond angles, and the strengths of these constraints depend on the local topology and the chemical nature of the elements. NMR spectroscopic studies of the short-range network structure reveal the nature of these constraints, thus enabling development of a quantitative structural model for borophosphate and borosilicate glasses. This combination of detailed structural understanding and topological constraint theory can explain the mixed network former effect (MNFE) in these types of systems, and gives accurate predictions for the composition dependence of glass transition temperature, liquid fragility and indentation hardness.